Main Canal – Delta Mendota Canal Intertie

Project Concept Development

West Stanislaus Irrigation District

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Background

The West Stanislaus Irrigation District (WSID) has determined that there is a need to establish an intertie between their Main Canal and the Delta-Mendota Canal (DMC), a part of the Central Valley Project (CVP), for the purpose of conveying and storing San Joaquin River Water, and other supplies which may become available south of the Delta (Warren Act Water). The water supply beneficiaries of the project will be the WSID and the numerous CVP water users south of the Delta. The initial plan was to construct a new pump station (Station 7) at the end of the Main Canal and construct approximately 1,500 feet of pipeline to deliver 100 cubic feet per second (cfs) into the DMC. WSID later decided to explore the idea of increasing the size of the project and the project benefit.

An analysis of the channel capacities of the six reaches of the Main Canal was performed. A summary report of the findings of this study is attached as Exhibit 1. Table 1 presents the results of this study as well as the approximate capacity of the six existing pump stations (Stations 1 through 6). The estimated pump station capacities were provided by WSID. The capacity of the current system is controlled by pump station capacity, with the exception of Reach 4 where the channel capacity and the pumping capacity are approximately equivalent. Based upon the study of channel capacity, it was decided to design the pump station to a capacity of 200 cfs to take advantage of the full channel capacity of the existing Reaches 5 and 6. It was understood that the existing Stations 5 and 6 would have to be enlarged to take full advantage of the new Station 7, but much of the time when there is capacity in the DMC to convey non-project water, there is little to no demand in WSID. The system capability would then be primarily dedicated to delivery of Warren Act Water to the DMC.

Table 1 Estimated Capacity of the Main Canal, West Stanislaus Irrigation District

Reach Designation	Estimated Channel Capacity (cfs)	Estimated Pump Station Capacity (cfs)	Current Reach Capacity
Reach 1	400	310	310
Reach 2	335	256	256
Reach 3	310	279	279
Reach 4	245	257	245
Reach 5	190	125	125
Reach 6	200	111	111

Due to the conditions of Station 6, it was necessary to make improvements to meet district water demand and provide some capacity to deliver Warren Act Water, by use of temporary pump and pipeline facilities. Plans are also underway to upgrade and enlarge Station 5.

In a meeting to discuss the existing and future right-of-way needs for Station 7 and the pipeline to the DMC, the option of constructing a new pump station upstream of Station 5, in conjunction with or in lieu of Station 7 was introduced. An increase in capacity of approximately 50 cfs could be achieved if the capacity restrictions from Station 5 to the end of Reach 6 are circumvented. The Reach 4 channel has a capacity of approximately 250 cfs. This concept was explored to assess the increased cost and benefits of a pump station constructed at this location. Construction at this location will be more costly due to the depressed topography and physical

right-of-way restrictions. Several options are also available depending on the future utilization of Stations 5 and 6. For the purposes of this study, a new station constructed at this location is referred to as Station 5A.

Based upon current DMC operational constraints in the Delta, it is assumed that pumping into the DMC can occur from November through June (the Transfer Months).

Alternate Intertie Pumping Configurations

Major intertie pumping configurations depend on the degree WSID will rely on Stations 5 and 6. With the Station 7 configuration, the pumping capacities of Stations 5 and 6 would need to be increased substantially or a new Station 5A and pipeline to Station 7 could supply the additional water to Station 7. Total capacity is limited to approximately 250 cfs without major upgrade upstream. There are four project configurations evaluated in this study which include:

A. A new intertie pump station (Station 7) connecting Reach 6 to the DMC with upgrade and enlargement of existing Stations 5 and 6 and enlargement of Reach 5.

B. Station 7 connecting Reach 6 to the DMC with a new pump station (Station 5A) and bypass pipeline to augment Stations 5 and 6 by connecting Reach 4 to Reach 6, and restoring existing Stations 5 and 6 to original capacities of 150 cfs and 100 cfs, respectively.

C. Station 5A and pipeline connecting directly to DMC providing service to Reaches 5 and 6, delivering remaining capacity to the DMC, and abandoning Stations 5 and 6.

D. Station 5A and bypass pipeline connecting directly to DMC, and expand Main Canal to increase total capacity.

Each of the four configurations will provide differing amounts of Warren Act Water as may be limited by either existing pumping capacity in the upstream stations or the available channel capacity in the upstream reaches.

Project Concept Development Considerations

A qualitative analysis was performed to determine the apparent best arrangement of facilities for the intertie. The analysis demonstrated that Alternative C or D would provide the best level of service and gauged to be very cost effective based upon the potential for water supply augmentation with Warren Act Water. The factors which lead to this conclusion are as follows:

1. The increase of transfer capacity of approximately 30,000 acre-feet per year gained by moving the pump station upstream of Station 5 justifies the increase in construction cost. This factor eliminates Configuration A.

2. It is more economical to construct one pump station (Station 5A at 250 cfs) than two pump stations (Station 5A at 100 cfs and Station 7 at 250 cfs) while continuing to rely on

existing eighty year old Stations 5 and 6 for the project life of an additional 30 to 40 years. These factors eliminate Configuration B.

Selection between Configurations C and D and the selection of the optimal size of the proposed Station 5A will depend on the capacity of the existing system and the amount on Warren Act Water to be gained by making selected improvements to the system determined through analysis of the capacity of the system elements relative to the demands on each element.

Main Canal Water Conveyance Capacity and Expansion Options

The existing capacity of each of the 6 Main Canal reaches is shown in Table 1. Based on a review of 2009 water delivery data provided by WSID, the existing system conveyed a maximum flow of approximately 540 acre-feet per day (afd) to meet WSID irrigation demands. During the Transfer Months, the maximum demand on the system was approximately 415 afd in May, with much of the period of April through June exceeding 300 afd.

An analysis of the Main Canal pumping and channel capacities was performed utilizing the 2009 water delivery data to compare project options and assess the benefit improvements to the system may have, as measured by the estimated increase in Warren Act Water during the Transfer Months resulting from the improvements. Each improvement to the system would remove a flow restriction. The analysis was performed by sequentially removing restrictions and estimating the Warren Act Water production. This analysis also allowed refinement of the Station 5A design capacity. The system configurations analyzed were as follows:

1. Utilize existing system capacities through Reach 6, as shown in Table 1, to convey through an intertie at the Proposed Station 7. This is the least cost option, analyzed to establish a baseline.
2. Abandon Stations 5 and 6 and install Station 5A with a capacity of 250 cfs utilizing existing system capacities through Reach 4.
3. Employ same configuration as Option 2, except increase the capacity of most limiting element of the Main Canal conveyance system, Station 2 along with Station 1.
4. Employ same configuration as Option 3, except increase the capacity of second most limiting element of the Main Canal conveyance system, Reach 4 channel, and the capacity of the previously modified elements.
5. Employ same configuration as Option 4, except increase capacity of third most limiting element of the Main Canal conveyance system, Station 4, and the capacity of the previously modified elements.
6. Employ same configuration as Option 5, except increase capacity of fourth most limiting element of the Main Canal conveyance system, Station 3, and the capacity of the previously modified elements.
7. Employ same configuration as Option 6, except increase capacity of fifth most limiting element of the Main Canal conveyance system, Reach 2 channel, and the capacity of the previously modified elements.

8. Employ same configuration as Option 7, except increase capacity of sixth most limiting element of the Main Canal conveyance system, Reach 3 channel, and the capacity of the previously modified elements.
9. Employ same configuration as Option 8 except increase capacity of all Main Canal conveyance system elements to deliver system demand plus 250 cfs to Station 5A each day in the Transfer Months.
10. Employ same configuration as Option 2, except increase capacity of all Main Canal conveyance system elements, to provide 250 cfs plus the maximum daily demands of Reaches 5 and 6, a total of 336 cfs through Reach 4, during the Transfer Months and increase Station 5A capacity to 336 cfs.
11. Employ same configuration as Option 10, except increase capacity of all Main Canal conveyance system elements, as necessary to provide a maximum of 336 cfs and a minimum of 250 cfs to Station 5A during the Transfer Months.
12. Employ same configuration as Option 2 except increase capacity of all Main Canal conveyance system elements and Station 5A to the Reach 1 channel capacity of 400 cfs.

The results of the analysis are presented in Table 2 with the system components needing enlargement and replacement in bold face type. An 85% utilization factor was assumed to account for occasional outages in pump station operation. At this stage in the analysis, the capital costs of the various configurations are not known, but guidance is given on the benefits each project will produce.

Table 2. Estimated DMC Delivery Potential for Nine-Months Off-Season Period[1]

Options	Intertie Pumping Capacity	Reach 6 Capacity		Reach 5 Capacity		Reach 4 Capacity		Reach 3 Capacity		Reach 2 Capacity		Reach 1 Capacity		DMC Delivery Potential[1]
		Channel	Pump Station[2]	Channel	Pump Station[2]	Channel	Pump Station[2]	Channel	Pump Station[2]	Channel	Pump Station[2]	Channel	Pump Station[2]	
	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(afy)
1_3	112	200	120	190	111	245	257	310	279	335	256	400	310	29,000
2_4	245	--	--	--	--	245	257	310	279	335	256	400	310	64,000
3_4	245	--	--	--	--	245	257	310	279	335	**301**	400	310	68,000
4_4	250	--	--	--	--	**257**	257	310	279	335	**315**	400	**324**	71,000
5_4	250	--	--	--	--	**279**	**279**	310	279	335	**317**	400	**329**	72,000
6_4	250	--	--	--	--	**305**	**305**	310	**310**	335	**335**	400	**352**	75,000
7_4	250	--	--	--	--	**307**	**307**	310	**310**	**348**	**348**	400	**360**	77,000
8_4	250	--	--	--	--	**337**	**337**	**355**	**355**	**361**	**361**	400	**360**	78,000
9_4	250	--	--	--	--	**395**	**395**	**415**	**415**	**451**	**451**	**459**	**459**	78,000
10_4	336	--	--	--	--	**336**	**336**	**367**	**367**	**397**	**397**	**405**	**405**	101,000
11_4	336	--	--	--	--	**395**	**395**	**415**	**415**	**451**	**451**	**459**	**459**	109,000
12_4	400	--	--	--	--	**400**	**400**	**400**	**400**	**400**	**400**	**400**	**400**	116,000

1. Delivery estimates based on 2009 delivery data for November through June, provided by WSID.
2. Existing Pump Station capacities provided by WSID.
2. Proposed Station 7
3. Proposed Station 5A
4. Capacities shown in Bold are upgrades to existing Main Canal facilities necessary to achieve the shown delivery potential at the given Intertie pumping capacity

Based upon this analysis, it appears that significant water transfer benefit thresholds result under options 2 through 5, and 11, which provide guidance for additional project decisions to narrow the options based on WSID review.

- With the existing Main Canal configuration and Station 7, Warren Act Water transfer was limited to approximately 29,000 afy.

- With the existing Main Canal configuration and proposed Station 5A, Warren Act Water transfer capacity increases to approximately 64,000 afy, an increase of 35,000 afy, with Station 5A at a pumping capacity of 245 cfs, which is approximately equivalent to the conveyance capacity of the most restrictive element, Station 1.

- With upgrades to the existing Main Canal system the transfer capacity can then be increased even further.

    - Improvements to the channel capacity along Reach 4 and the pumping capacity for Station 1 and Station 2 could yield an additional 7,000 afy, increasing transfer capacity to 71,000 afy, with a Station 5A capacity of 250 cfs.

    - For Station 5A capacity of 250 cfs, the maximum achievable transfer capacity would be approximately 78,000 afy.

    - To increase transfer capacities above 78,000 afy would require increased pumping capacity through Station 5A above 250 cfs along with increased Main Canal system capacity.

If consideration is to be given to expanding the project to reap additional benefit, we would recommend preparation of a pre-design report to define the proposed project and provide a complete project description before detailed design is resumed.